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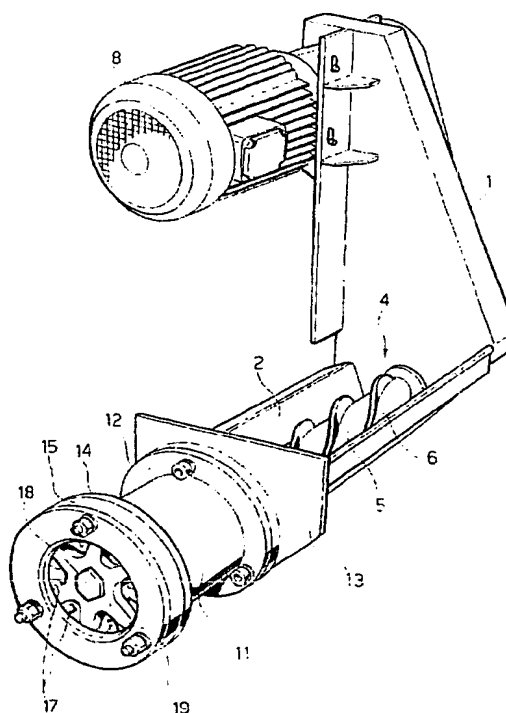
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(54) **Self-feeding shredder device for machine tools with swarf removal**

(57) A self-feeding shredding device, particularly for liquid lubricant/refrigerant filtration plant for machine tools with swarf removal, incorporating a channel element (2) in which a motorised screw conveyor (4) sits, having one end of reduced diameter (10) that passes through an internally grooved cylindrical body (11). A lobe rotor (19) is axially faced up against the outside of the grooved cylindrical body (11) and its rotation controlled by the screw conveyor (4). The swarf, unwound and stretched out from the reduced diameter end tip (10) of the screw conveyor (4) along the grooved cylindrical body (11), is pushed towards the lobe rotor (19) and shredded.

FIG. 1



EP 1 151 822 A2

Description

[0001] The present invention refers in general to machine-tools with swarf or chips removal.

[0002] Traditionally, in industrial plants that use such machine tools, the relative lubricant/refrigerant liquids and machining swarf are transported, generally via inclined floor-level channels, to filtration plants that separate the solid parts from the liquids so that the latter can be reutilised.

[0003] This solution involves evident complications due to the layout of the channels, as well as the space occupied by the channelling and flexibility problems in relation to the positioning of the machine tools.

[0004] Hence, it would be auspicious to eliminate these channels and connect the lubricant/refrigerant liquid discharges from the machine tools with the filtration plant via a network of overhead pipes, which is less complicated, less space-consuming and much more flexible when setting up. Nevertheless, this requirement does not reconcile with the presence of long metal swarf in the lubricant/refrigerant liquids. Such swarf is normally of variable length and every several centimetres long, and therefore cannot be transferred to the filtration plant connection piping using normal hydraulic pumps.

[0005] The object of this invention is that of solving this problem and to reduce the swarf length so as to enable the pumping of lubricant/refrigerant liquids containing swarf using normal hydraulic pumps.

[0006] According to the invention, this objective is achieved by a self-feeding shredder, characterized by the fact that it consists of a conveyor including a channel element for feeding the lubricant/refrigerant liquids in which a motorized screw conveyor sits, the end tip-of which constitutes the advancement member of a shredding group, including an internally grooved cylindrical body arranged coaxially to the said end tip of the screw conveyor and a lobe rotor axially faced against the outside of the said grooved cylindrical body and controlled in rotation by the said screw conveyor.

[0007] The combined effect of the rotation of the screw and the presence of the grooves inside the cylindrical body of the shredding group creates an effective unwinding, straightening and stretching action on the elongated particles of metal swarf as they are self-fed to the rotor. The interaction between the lobes of the rotor and the extremity of the grooved cylindrical body faced against it produces a grinding and shredding action, reducing the size and length of the metal swarf particles to levels at which they can be pumped, together with the lubricant/refrigerant liquids, to the filtration plant.

[0008] The same advantageous functional result is achieved even in the case the shredding device according to the invention is employed for the mere disposal of the swarf produced by the machine tools, i.e. independently of the presence of a lubricant/refrigerant filtration plant, and/or of distribution and/or conveying sys-

tems for the lubricant/refrigerant liquids and swarf (e.g. even in the case the swarf are removed by means of collecting containers).

[0009] In order to render the unwinding and stretching effect on the elongated swarf more efficient, the aforesaid end tip of the screw conveyor has a diameter that is opportunely smaller than that of the rest of the aforesaid screw. This end tip is equipped with an opportune end tang that stands proud of the aforesaid cylindrical body and on which the lobe rotor is engaged for rotation.

[0010] Another characteristic advantage of this invention is that the motorised group driving the screw conveyor is equipped with a counter-rotation device, which is set up to automatically intervene during normal running in cases where rotation of the screw slows down or stops due to swarf clogging or blockages.

[0011] The invention will now be described in detail with reference to the attached drawings, which are supplied purely as a non limitative example, wherein:

- Figure 1 is a schematic perspective of a self-feeding shredding device according to the present invention,
- Figure 2 is a longitudinal, side-section view of figure 1,
- Figure 3 is an exploded view of figure 1,
- Figure 4 is a larger-scale front view of a first example of lobe rotor actuation on the shredding device, and
- Figure 5 is a similar view of a second type of lobe rotor actuation.

[0012] According to the present invention, the self-feeding shredding device, as exemplified in the drawings, includes a support frame, generically indicated as item 1, arranged for mounting in correspondence with the lubricant/refrigerant liquids outlet of a machine tool or group of machine tools with swarf removal.

[0013] The lower part of the support frame (1) carries a horizontal channel element (2), the bed of which has a series of slots (3) and in which a motorised screw conveyor (4) sits.

[0014] In the example shown, the screw conveyor (4) incorporates a long tubular element (5) with the blade (6) of the screw mounted on its external surface and coupled at one end to a shaft (7). The shaft (7) is mounted on the frame (1) using, for example, roller bearing supports (not shown) to allow rotation and is connected to a motorised drive group. In the case of the example shown, this group is comprised of an electric motor and a chain drive indicated schematically as item 9.

[0015] A counter-rotation device is opportunely coupled with the motorised drive group. This counter-rotation device might incorporate a sensor for the angular speed of the shaft (7) or an absorption sensor for supply current to the motor (8), suitable for automatically controlling - for motives explained in the following - the halting and rotation of the screw conveyor (4) in the opposite

direction to that of normal running for a predetermined number of revolutions.

[0016] The height of the screw blade (6) is reduced in correspondence with the end tip (10) of the screw conveyor (4). This tip (10) passes coaxially through a cylindrical sleeve (11) having on its inner circumference a series of grooves (17), which may be oriented axially or with an angle relative to the axis of the sleeve (11), and is fixed at one end, via a flange (12), to a vertical support plate (13) that is, in turn, rigidly fixed to the channel element (2).

[0017] The other end of the grooved cylindrical sleeve (11) has another flange (14) onto which a bottom ring (15) is fixed.

[0018] An axial tang (16) coupled in rotation within the end tip (10) of the screw conveyor (4) has a prismatic tip (18) onto which a lobe rotor (19) is keyed.

[0019] This rotor (19), which axially faces the external end of the grooved cylindrical body (11), can have from 2 to n lobes: figures 4 and 5 show two examples of alternative implementations in which the rotor has respectively six and four lobes, or radial arms.

[0020] In operation, the lubricant/refrigerant liquid and small-size swarf are discharged under gravity from the bed of the channel element (2), via the relative slots (3), to a collection tank for pumping to the filtration plant.

[0021] Longer particles or accumulations of swarf are transferred by the screw conveyor (4) in the direction of its end tip (10). Due to the reduced height of the screw blade (6) and the presence of the grooved cylindrical body (11), the swarf is subjected to an unwinding and stretching action in this end tip zone (10), whilst being simultaneously advanced in the direction of the rotor (19). Due to the effect produced by the interaction between the edges of the lobes of the rotor (19) and the end of the cylindrical body (11) facing them, the swarf is subjected to a grinding and shredding action.

[0022] Following this grinding and shredding action the swarf, which leaves the device via the bottom ring (19), reaches the collection tank where it is pumped with the lubricant/refrigerant liquid to the filtration plant.

[0023] In cases where swarf amasses and clogs in the end tip (10) zone to the extent that it causes the rotation of the screw conveyor (4) to slow down or even stop, the previously described counter-rotation device will automatically rotate the said screw conveyor (4) in the opposite direction for a brief period of time to restore normal operating conditions. Nevertheless, it is necessary to underline that the risk of swarf blockage is reduced by the fact that the end tip (10) of the screw conveyor (4) is not supported, but is free to float radially with respect to the grooved cylindrical body (11).

[0024] Naturally, it is understood that the constructional details and the forms of realization could be extensively changed with respect to that described and illustrated without leaving the scope of this invention, as defined in the following claims. Thus, as already pointed out in the above, the shredding device according to the

invention can also be advantageously employed for the mere disposal of the swarf produced by the machine tools, i.e. even in the absence of lubricant/refrigerant filtration plants, and/or of conveying systems for the lubricant/refrigerant liquids and swarf (e.g. even in the case the swarf are removed by means of collecting containers).

10 Claims

1. A self-feeding shredding device for machine tools with swarf removal, **characterized in that** it includes a conveyor incorporating a channel (2) for feeding the lubricant/refrigerant liquids and in which a motorised screw (4) is positioned, the end tip (10) of which constitutes the drive member for a shredding group incorporating an internally-grooved cylindrical body (11) arranged coaxially with respect to the said end tip (10) of the screw conveyor (4) and a lobe rotor (19), axially faced against the outside of the said grooved cylindrical body (11) and rotationally driven by the said screw conveyor (4).
2. A shredding device according to Claim 1, **characterized in that** the said end tip (10) of the screw conveyor (4) has a smaller diameter than the rest of the said screw conveyor (4).
3. A shredding device according to Claim 1 or Claim 2, **characterized in that** the said end tip (10) of the screw conveyor (4) has an end tang (18) that stands proud of the said grooved cylindrical body (11) and on which the said lobe rotor (19) is coupled in rotation.
4. A shredding device according to Claim 3, **characterized in that** the said lobe rotor (19) is inserted inside a bottom ring (15) frontally fixed to the said grooved cylindrical body (11).
5. A shredding device according to any of the previous Claims, **characterized in that** the said lobe rotor (19) is equipped with a number of lobes ranging from 2 to n, preferably from 4 to 6.
6. A shredding device according to any of the previous Claims, **characterized in that** the said channel element (2) is equipped with bottom openings (3).
7. A shredding device according to any of the previous Claims, **characterized in that** the first end (7) of the said screw conveyor (4) is functionally connected to a drive group (8, 9) equipped with an automatic counter-rotation device.
8. A shredding device according to any of the previous Claims, **characterized in that** the grooves (17) of

the said cylindrical body (11) are arranged axially.

9. A shredding device according to any of Claims 1-7, **characterized in that** the grooves (17) of the said cylindrical body (11) are angled with respect to the axis of said cylindrical body (11). 5
10. A shredding device according to any of the previous Claims, **characterized in that** the end tip (10) of the screw conveyor (4) is radially floating with respect to the said grooved cylindrical body (11). 10

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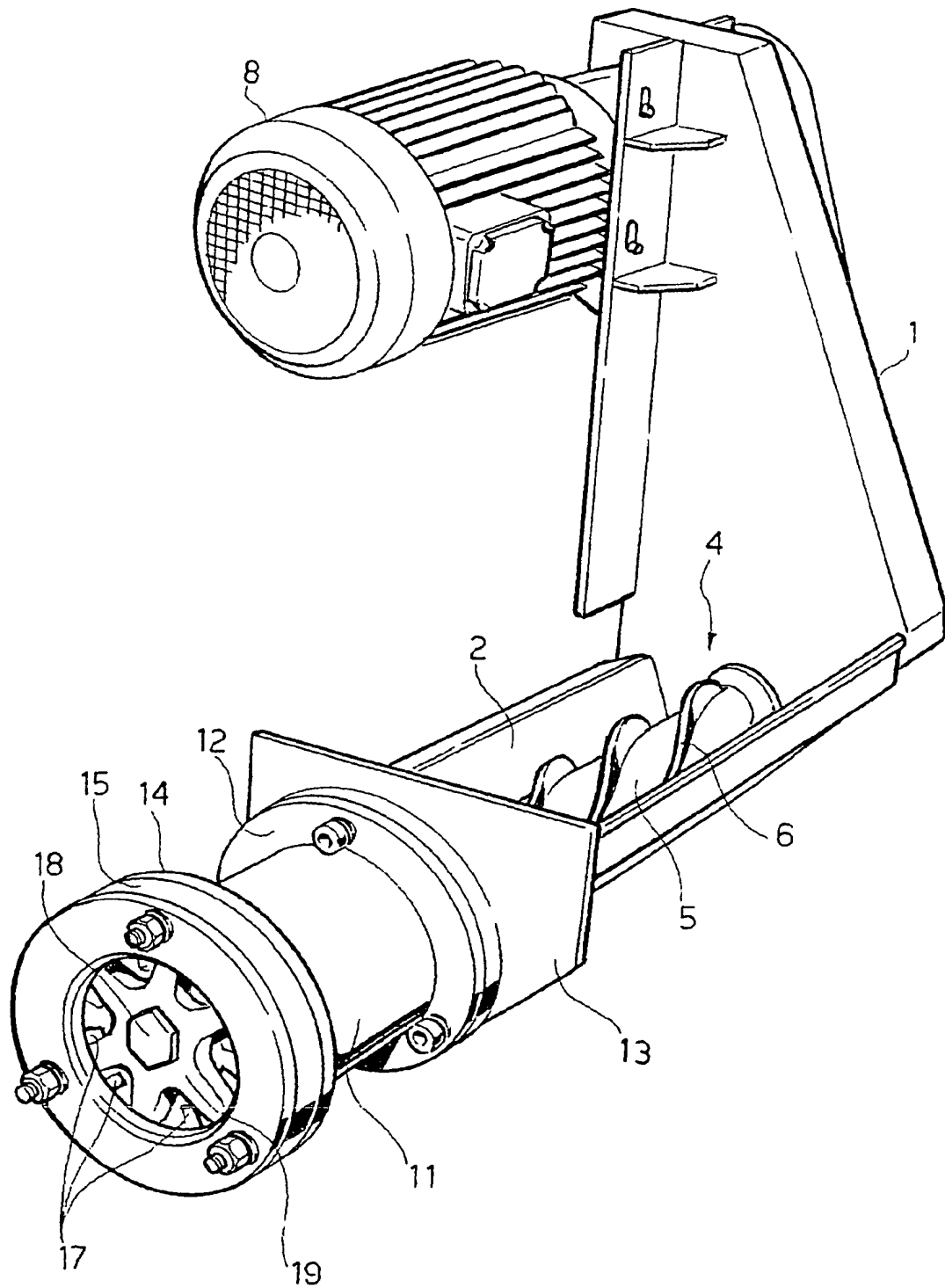
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FIG. 1



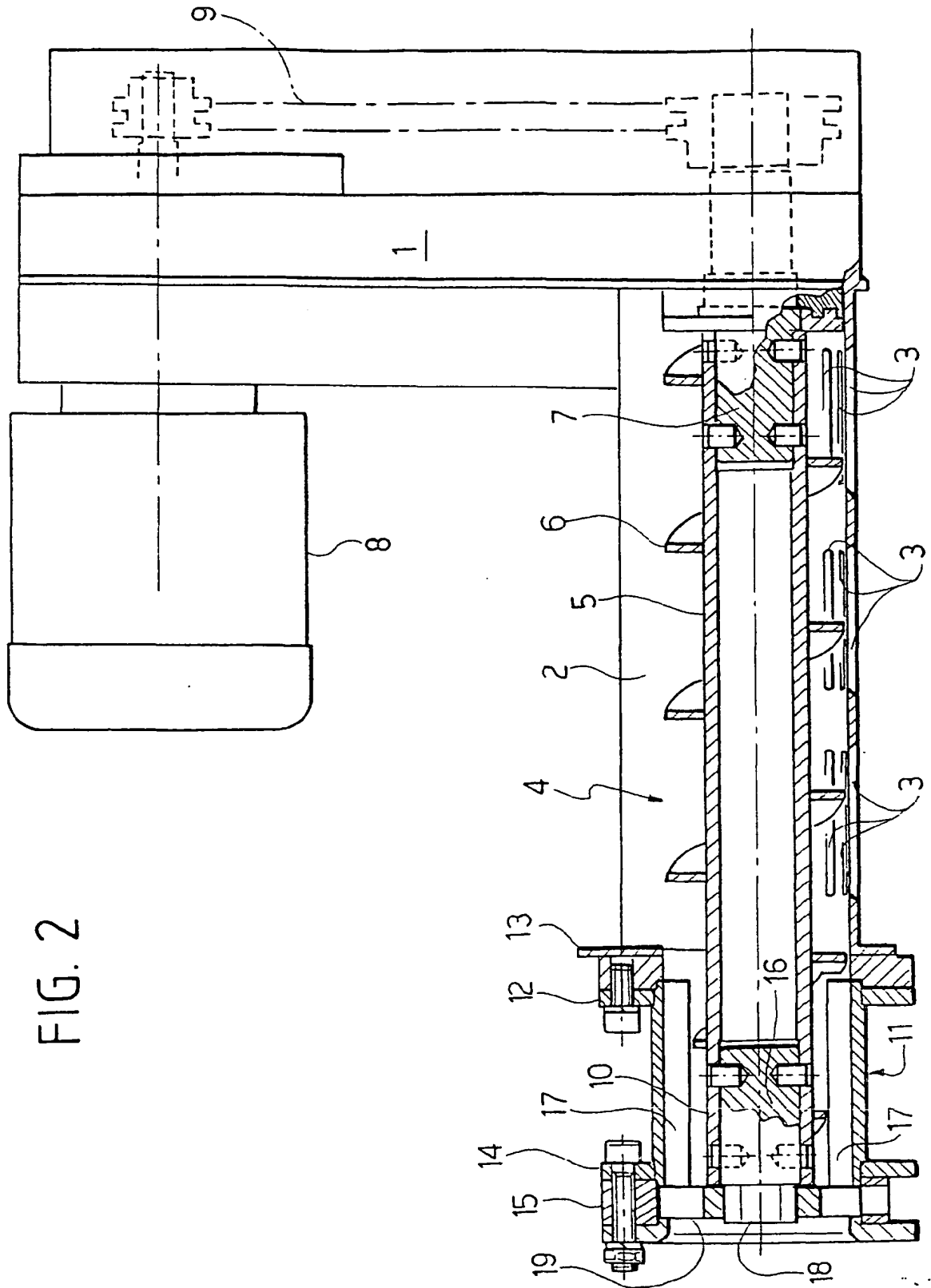


FIG. 3

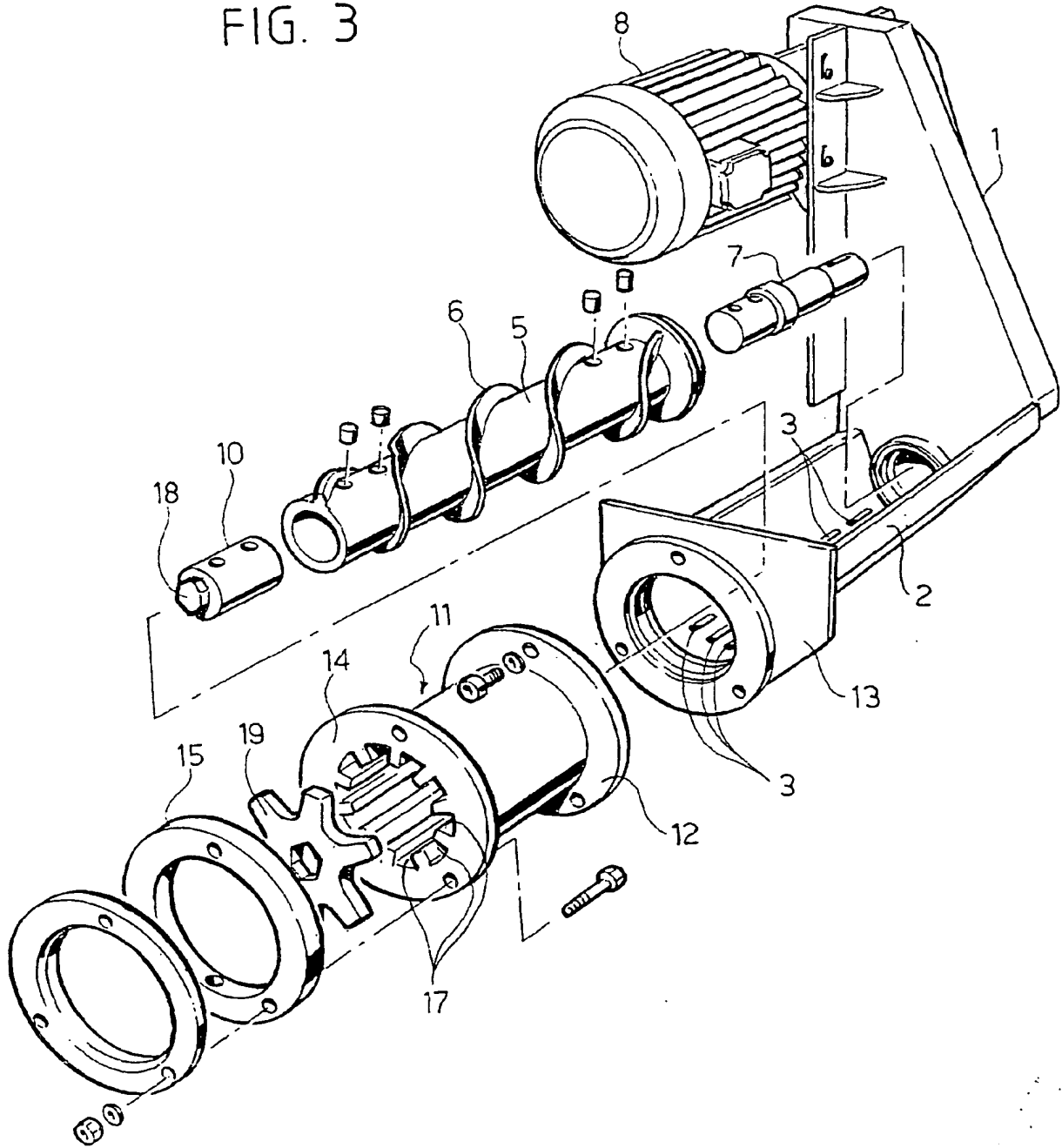


FIG. 4

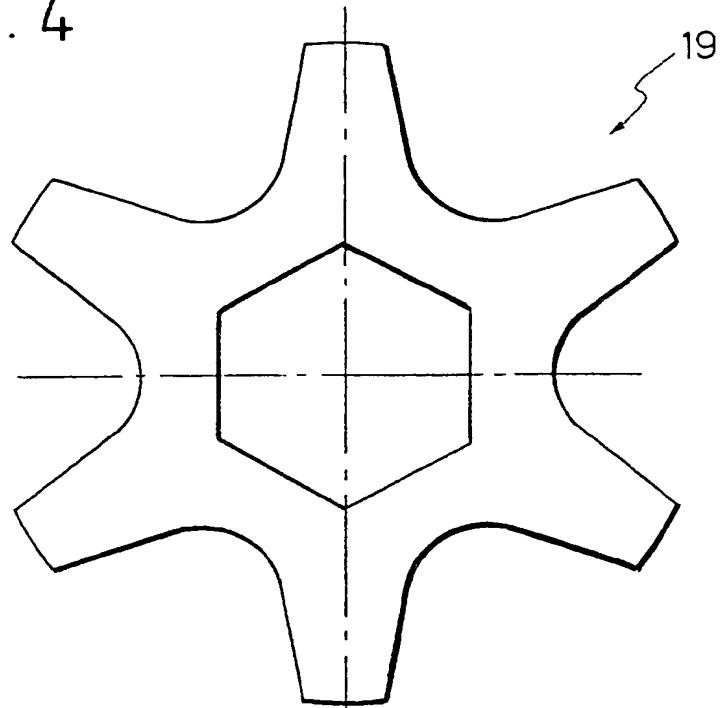
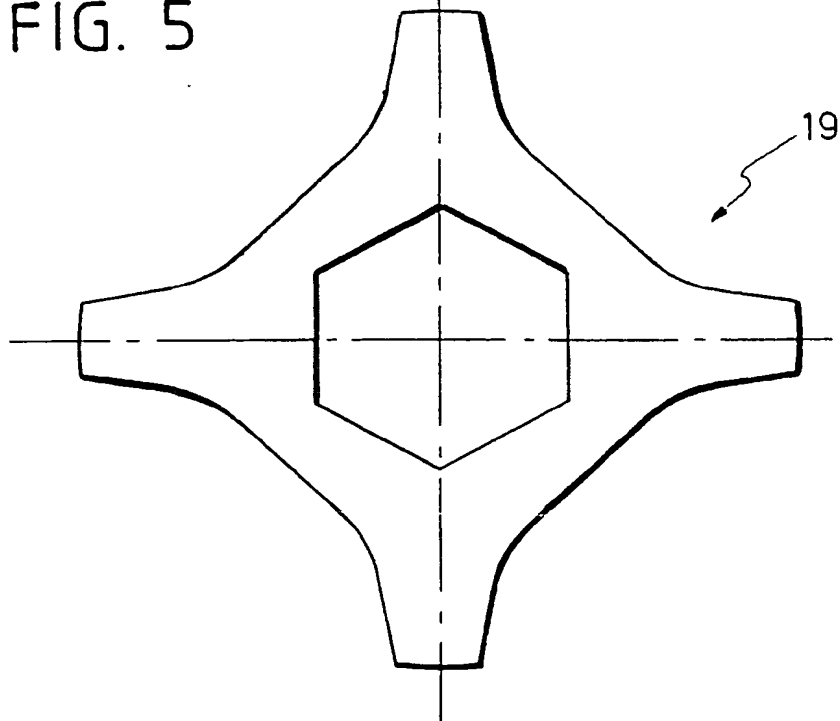


FIG. 5



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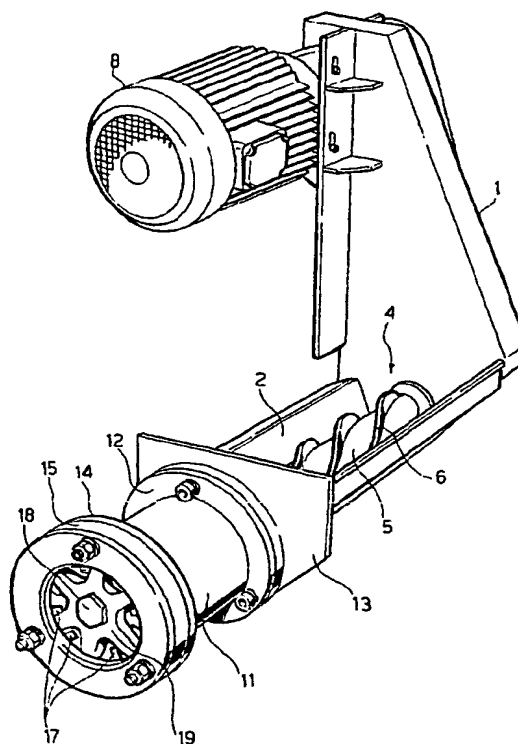
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FIG. 1



EP 1 151 822 A3



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EUROPEAN SEARCH REPORT

Application Number
EP 01 83 0007

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Place of search THE HAGUE		Date of completion of the search 24 September 2003	Examiner Breare, D
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